

## 7B: Harmful Algae in Puget Sound: From Research to Management

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### Questions & Answers

**A:** [In response to a question that was not recorded:] OK, what you're thinking about is a publication put out by the Washington Sea Grant Program called "Gathering Safe Shellfish in Washington." At least, I think that's it. This does not have the different languages, as far as I know. But you could ask the person at the Sea Grant desk out here.

**Comment:** The other place to start is the State Department of Health.

**Cox:** Our department has a number of small publications and we have a few big single sheet posters that have different languages printed on it. There are about seven or eight languages, but it doesn't sound like what you're describing as a three part poster. Ours is just one part.

**Q:** [Unrecorded question about the temperature regime.] Was it unusually warm?

**Cox:** Out off the coast of Long Beach, water temperatures were recorded at 17 degrees centigrade. At 20 degrees centigrade, oysters spawn, and normally this time of year (I'm not an expert on the oceanography out there) I believe the temperatures are closer to 10 or 11 or 12 degrees. So very definitely we had elevated temperatures. There weren't people out taking water samples all over throughout these areas, but we generally had a calm, sunny condition and I think it probably created a warm stratified layer on the surface. Again, I'm not an oceanographer and I can't say that we documented that, but I suspect that that may have played a part in the blooms.

**Q:** Department of Ecology has records of temperatures in Willapa and Gig Harbor and Puget Sound areas, of course. We also have a special project in Willapa Bay and we have moorings there and we are continually monitoring temperature every 15 minutes in addition to additional study that started in the end of July. There's a poster at this conference displaying that temperature data.

**Cox:** When the shellfish samples inside Willapa Harbor went from nothing to "over the limit" from the 10th to the 13th, I think that really demonstrates that the changes occur very abruptly, and that in order to document those changes and the conditions that cause the event itself, you almost have to be doing daily sampling and testing because, if you go out twice a week or once a month, you easily could miss a bloom like this.

**Q:** But if you have every 15 minute sampling, then that gives some potential predictive value that when you have these unusually high temperatures, step up the monitoring.

**Cox:** It could do that, yes.

**Q:** [Unrecorded question] about how long do these animals retain PSPs?

**Trainer:** No. That was one thing I did want to look at, but I had so many things that I wanted to look at, I had to narrow it down. But somebody in Alaska is doing a study with Jack Wekell.

**Q:** Is that a probable explanation for why you see it and you don't see it in the mussels?

**A:** That could be. I don't know. This is the first study of any kind that's been done like this. It could just be variability alone.

**A:** [In response to an unrecorded question:] Like next month. I mean that sort of data already exists because it comes out of the weather prediction models that used it in atmospheric science. We're working to incorporate it right now. That's not a fundamentally hard problem. The physics already exists in the model, it just wasn't done on the first year long run.

**Trainer:** [In response to an unrecorded question:] That's an excellent question and I'm trying to track that data down. It turns out that as far as aerial photographs, nobody was taking pictures then from any of the sources that I had tried to look for and I'm looking into some satellite images now. I'm not sure they're going to have the resolution that's quite high enough for me for the beginning of the bloom to see where the bloom began.

**Trainer:** [In response to an unrecorded question:] That's a good question. Late in August, we found a large number of cells that had actually sunk to the bottom of the cove or to 15 meter depths. They were somewhat unhealthy-looking cells, but they were alive, and my theory is that these cells are able to live at depth in cooler temperatures and in maybe a different life stage, an asexual vs. sexual life form, to live at depth until the conditions become prime for a bloom in the next year. But that's just a theory at this point. I think they're resident within the cove. OK, now I'd like to open the floor to discussion, to any of the questions for any of the speakers who spoke during this session. We have a few minutes.

**Q:** Rita, I'm going to apologize because if you mentioned this, I wasn't here for your talk, unfortunately. Everyone knows about the 800 number the Department of Health maintains when you want to ask or hear a recording whether there are known blooms of toxic or potentially toxic algae, but I wondered if the hotline that you and Jim Postel have, if that is still continuing, and if people generally know about it. You know, if you're out in the Sound and you see a bloom, that you can call this number. Is that still available?

**Horner:** That number is no longer still available as a separate number, but you can call either my phone number at the University or Jim's and leave voice mail if you do see blooms, and I will be more than happy to give you those numbers. Mine is 206/543-8599 and Jim's is 543-6141.

**Q:** I'm curious about the effects of grazing... [end of question not recorded]?

**A:** It appears that some of these organisms are not grazed on by zooplankton. *Heterosigma* is one of those. In fact, it looks like things like ciliates will actually reverse the direction of their aboral cilia in order to get rid of *Heterosigma*. But we do have a little bit of limited data that show that copepods, for example, will graze on *Pseudo-nitzschia* and there are a number of things that will also do some grazing on *Alexandrium*. But whether these will actually control blooms or not, we don't know.

**Comment:** I just want to add to that. I know there's a funded study on the East Coast looking at viral vectors as a means of mitigation and control of harmful algal blooms. I think we need to be careful with mitigation procedures. That's my feeling.

**Q:** Yesterday there was presentation on exotic species and they pointed out that San Francisco Bay apparently has been colonized by organisms that filter higher water volumes. Is there any work going on and do any of the panel members know are harmful algal blooms reduced in sites like San Francisco Bay?

**A:** The fellow at lunch yesterday did say that it definitely decreased the amount of algae in those places. It was a big effect.

**Q: Just a follow up to the first question to Rita. Could you give any more enlightenment as to life cycles in some of these organisms?**

**Horner:** How long do you want to stay? The *Alexandrium* life cycle is pretty well worked out and it produces two kinds of cysts. One kind is a temporary cyst that form as the result of poor environmental conditions. These are temporary and only last for a short period of time. The other kind is a cyst that's produced as a result of sexual reproduction and these are so called dormant cysts, the ones that go to the bottom and may sit for some period of time. They actually need a dormancy period before they'll regeminate. For *Pseudo-nitzschia* there is one record, one time from a species from the Antarctic that went sexual for some reason that nobody was ever able to figure out. But there are some suggestions that maybe it also has a sexual life cycle. *Heterosigma* I think just divides but also can form resting cysts. So the life cycles are quite varied.

**Trainer:** [In response to an unrecorded question:] If you are referring to the study in Penn Cove, I think that those cells were probably directed toward the inner part of the cove by a fresh water lens, so there was a gradient of salinity on the outside and the inside of the cove that, I believe, directed those cells toward the inside because there was a relaxation of that at the next sampling time. Do you want to direct that question to someone else?

**Comment:** Vera, let me say something about the outside coast that I didn't mention in my talk. Normally, when we're monitoring razor clam on the outside coast, and we're monitoring the shellfish in Grays Harbor and Willapa, we see that the razor clam will show evidence of PSP first. In this bloom that we had in the fall of 1997, that wasn't the case. The razor clams off of Grayland never did show any toxicity whereas the blooms appeared to have originated inside Willapa and Grays Harbor, which is contrary to what we normally think – that the PSP blooms usually move in from deeper water and occur on the outside coasts first. So it's very different depending on where you are.

**Q:** As someone involved in the shellfish industry and also somebody who enjoyed the sunshine last November, I can't help but wonder about the relationship between the lovely November weather that we had and the fact that we also had the PSP blooms. I guess my question is to Parker. Is there any way to incorporate levels of light? Is there a model?

**MacCready:** Yes, absolutely. I think that that's part of how the heat budget works and that is something that comes out of the weather data that would be provided by essentially the same people who predict the weather that you hear on the news, are able to provide that kind of information. Especially hindcasted, you know, after the fact.

**Q: Going back and reexamining what happened last fall?**

**MacCready:** Oh yes, that would be a lot easier to do than to predict what is going to happen next fall.

**Comment:** I know that there are skeptics as to whether or not models can be created to be predictive in the case of harmful algal blooms, but I think that we do see some common threads just between the bloom that was observed, the *Heterosigma* bloom off Bainbridge and then the bloom of *Pseudo-nitzschia*, although it was not at high levels in mussels. I think that we have some common factors which do promote initiation and concentration of these blooms. So I'm very excited about the possibility of modeling these efforts.

**Mearns:** I'm not an expert on this subject, but I've been trying myself to get some remote sensing, some satellite images in California and have gotten frustrated with the resolution and so on. I think I detected a little bit of that in your comment earlier. I'm wondering about the status, it seems to me we do have a big picture thing here that we need to watch and look for and are we being limited by the resources that we have to look at some of these big picture as well as the small scale things like the question that Ron

just asked about, do these things really start in the center somewhere. What is our experience with remote sensing, and where do you think it out to be?

**A:** With regard to ocean colors, we had a satellite sensor up from 1978 to 1986, that was the coastal zone scanner. That died and then in, I think it was a year ago, the Japanese launched a satellite. That had a one-kilometer resolution of ocean colors. That died after about nine months. The US launched a satellite last August, and that's been operational since September. At University of Washington, as part of PRISM, we are now starting to get one-kilometer data and we have to look into all the legal technicalities of posting it on the website, because it is a NASA-industry cooperation. But it has one-kilometer resolution, so that's going to hit the strait and the main basin. The thing that's really exciting for the future, is the year 2000 or 2001: the navy at NRL, in cooperation with industry, will be launching a sensor that has a 30 meter resolution. We're able to start looking at the scale that's really going to be important in terms of Puget Sound. And I'm involved with some of those programs through the office of medical research. So perhaps at about the two-year timetable, we'll be able to come back to this time and see a little bit of information.

**Panelist Question:** But those are blooms in general, not necessarily harmful blooms. Is that right?

**A:** It's everything that's the same color as well. But what's interesting and what I didn't realize from some of the comments of the speakers this afternoon, is that is the observations were made by eye, so I think that has some potential. If you know that there's a color development then you can go out and monitor it, then you can get a big picture view to predict with the model.

**Panelist:** *Heterosigma* would be the one that you could probably monitor using satellite, but some of these others would probably be very difficult because often they are present at very low cell numbers and the blooms may be subsurface. They would be a lot harder to do anything with that way.

**Q:** Kelly, you mentioned the receptor binder assay, or something like that. Can you just say a little bit about that?

**Curtis:** Well, I haven't actually started the work yet and I haven't actually seen the method before. I will be doing the work with Vera, and she knows a lot more about that than I do.

**Trainer:** Basically it utilizes a purified nerve receptor and a radioactively labeled saxitoxin molecule, and it looks in the sample at the displacement of that radio labeled molecule from the receptor. It's a lab-based biochemical method. It's not used in the field yet, but it's advantages are that many samples can be run on one day and it doesn't use mice or live animals. So we're interested in comparing mouse bioassay data with the receptor binding assay to see about possibly utilizing it for regular monitoring in the future.

**Q:** What are the relative costs of that?

**Curtis:** From what I've read, the receptor binding assay costs about 11 or 12 cents a test, excluding labor costs. And the mouse bioassay costs about \$11 per test.